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**Declarations under Rule 4.17:**

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

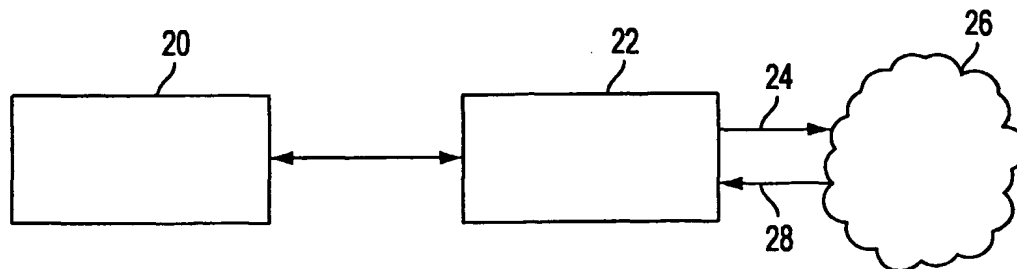
— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

**Published:**

— with international search report  
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: TWO-DIMENSIONAL (2D) ARRAY CAPABLE OF HARMONIC GENERATION FOR ULTRASOUND IMAGING



(57) Abstract: A two-dimensional (2D) array transducer capable of transmitting ultrasonic energy in tissue at a fundamental frequency and of sufficient power to generate a harmonic of the fundamental frequency. In particular, the invention requires that at least 25% of the array elements are excited to transmit the ultrasonic energy, that the transducer array has a checkerboard pattern, that high voltage electronics are housed in a transducer handle, that transmit and receive beamforming electronics are housed in a transducer handle, that high voltage electronics connected to transmit elements in the transducer and low voltage electronics connected to receive elements in the transducer are housed in the transducer handle, and that elements forming the array are of a single crystal.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB2004/001116

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 B06B1/02 B06B1/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 461 299 B1 (HOSSACK JOHN A) 8 October 2002 (2002-10-08)  column 1, line 8 - line 11 column 2, line 63 - column 3, line 3 column 3, line 21 - line 25 column 4, line 4 - line 15 column 6, line 32 - line 54 column 11, line 10 - line 15; figure 4f	1-3,5, 11, 35-37, 39,45, 53-58, 60,66,74
A	US 2002/108220 A1 (HANAFY AMIN M) 15 August 2002 (2002-08-15) paragraphs [0002], [0009] - [0011], [0014], [0017], [0027] - [0031], [0037]  ----- -/--	1,35,55

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the International filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB2004/001116

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2001/043090 A1 (SAVORD BERNARD J) 22 November 2001 (2001-11-22) cited in the application  abstract	4,16-18, 38, 50-52, 59,71-73
A	EP 0 641 606 A (ACUSON) 8 March 1995 (1995-03-08) abstract	1,35,55

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2004/001116

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-5, 10, 11, 16-18, 35-39, 44-45, 50-60, 65, 66, 71-74

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-5,10,11,16-18,35-39,44-45,50-60,65,66,71-74

A two-dimensional array transducer comprising a high voltage field effect transistor.

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2. claims: 6-9,19-34,40-43,61-64

A two-dimensional array transducer comprising piezoelectric elements.

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3. claims: 12-15,46-49,67-70,75-78

An array transducer having a checkerboard pattern.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB2004/001116

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6461299	B1	08-10-2002	NONE	
US 2002108220	A1	15-08-2002	US 6415485 B1 US 6043589 A	09-07-2002 28-03-2000
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EP 0641606	A	08-03-1995	US 5415175 A US 5438998 A AT 189415 T AU 688334 B2 AU 7020994 A CA 2129946 A1 DE 69422867 D1 DE 69422867 T2 EP 0641606 A2 JP 3478874 B2 JP 7107595 A US 5976090 A US 5582177 A US 5792058 A	16-05-1995 08-08-1995 15-02-2000 12-03-1998 23-03-1995 08-03-1995 09-03-2000 07-12-2000 08-03-1995 15-12-2003 21-04-1995 02-11-1999 10-12-1996 11-08-1998